

REMARKS

Claims 1-21 were originally filed in the present application. As a result of a requirement for restriction and an election of species, claims 1, 3, 9-11, 18, 20 and 21 are withdrawn from consideration by the Examiner as not being readable on the elected invention. As a result of the present Amendment elected claims 2, 4-8, 12-17 and 19 are presently under consideration. Also, claims 22-26 have been added to the present application. It is believed that claims 22-26 are properly examinable with the elected invention but if the Examiner decides otherwise, entry of claims 22-26 as being withdrawn for consideration for prosecution at a later time is respectfully requested.

Claims 2, 4/2, 5/2, 6/2, 7/2, 8/2, 12/2, 13/12/2, 14/12/2, 15/12/2, 16, 17 and 19 have been rejected by the Examiner under 35 USC 102(b) as being anticipated by Freytag et al., U.S. Patent No. 3,596,696 or Buckwalter et al., U.S. Patent 2,927,051 or Jadamus et al., U.S. Patent 5,153,076 or Gifford et al., U.S. Patent 5,198,050. Also, claims 2 and 5/2 are rejected by the Examiner under 35 USC 102(b) as being anticipated by Ogawa, U.S. Patent 4,461,795 or Kaido et al., U.S. Patent 5,938,869 or Lin et al., U.S. Patent 5,040,583. These rejections are respectfully traversed.

The present invention is directed to a rubber-reinforcing structure comprising a polyamide resin layer which is bound directly to a sulfur-containing rubber layer wherein the rubber layer is bound to the resin layer without the use of an adhesive. More specifically, the present invention is directed to a process for producing a rubber-reinforced structure which comprises the steps of treating a surface of a polyamide resin layer with a specific solvent and bringing the resin layer into contact with a specific sulfur-containing rubber layer and vulcanizing the composite to bond directly the specific sulfur-containing rubber layer to the resin layer with a specific vulcanization-activating agent, without the use of an adhesive. Advantageously, the vulcanization-activating agent includes an organic compound having a

carbon-carbon double bond and a maleimide-series compound. In addition, as recited in newly added claim 26 of the present application, the surface of the resin member is treated with a solvent capable of dissolving or swelling the resin member. Please see in this regard page 82, lines 24-27 of the present application.

Freytag et al. disclose an article of manufacture comprising vulcanized rubber bonded to a textile, said textile being either an untreated textile or having an adhesion promoting surface coating thereon, the rubber of said article of manufacture adjacent said untreated textile or said surface coated textile having incorporated therein, prior to vulcanization, as a first additive, of a member selected from hexamethylol melamine, a lower aliphatic carboxylic acid ester of hexamethylol melamine and a partial lower alkyl ether of hexamethylol melamine, and the like and, as a second additive, a member selected from resorcinol, m-aminophenol, m-phenylene diamine, resorcinol diacetate, and the like, said rubber being selected from the group consisting of natural rubber, polyisoprene, polybutadiene, polychlorobutadiene and copolymers of butadiene and styrene, and the like, and blends thereof, and said textile being selected from rayon, polyamide, polyester, polyacrylonitrile and cotton.

Freytag et al. describe that in a large number of rubber articles designated to withstand considerable stresses in use, the rubber is reinforced with plies of textile materials. Thus, tires, rubber hose and belts are commonly reinforced with filamentary textiles in the form of yarns, cords or fabric (see Col. 1, lines 11-14). Further, in Example 2, the rubber composition containing sulphur, hexamethylol melamine and the like is bonded to nylon cord filaments. The Freytag et al. reference provides improved adhesion between rubber and untreated textile materials (see Col. 1, lines 34-36).

Buckwalter et al. disclose a method of adhering tire cord to a rubber stock comprising incorporating in the rubber stock, resorcinol and the reaction product of formaldehyde and 1,3-diaryl guanidine, thereafter uniting said rubber carcass stock with the tire cord, and thereafter heating the assembly to vulcanize the rubber and form an adhesive-like condensation product

from the resorcinol and the 1,3-diaryl guanidine-formaldehyde reaction product, said adhesive-like product adhering the tire cord to the rubber carcass stock.

Buckwalter et al. mention that the classes of textile fibers or filaments that can be adhered to rubbers by the method herein described include native cellulose (e.g., cottons), regenerated cellulose (e.g., rayons), and synthetic linear polyamides (e.g., nylons) (see Col. 3, lines 59-63). Further, resorcinol (I) may be introduced into the rubber, or carbon black masterbatch, in its commercially available solid form, as a concentrated aqueous solution, or as a rubber masterbatch. After the introduction of resorcinol (I) curing aids, accelerators, antioxidants, etc., are then added and are followed by the addition of 1,3-diaryl guanidine-formaldehyde reaction products (II) (granulator or powder) and finally sulfur. Furthermore, vulcanizable rubber stocks containing the adhesive-forming chemicals described above can be reinforced with untreated textiles in the several manufactured forms noted earlier. For example, thin sheets or webs of staple fiber in a random or an oriented state may be coated on one or both sides with the adhesive stock to yield non-woven textile-reinforced rubber; or, the fiber may be incorporated into the rubber by milling, etc., and subsequently sheeted to the desired gauge (see Col. 4, lines 35-43). Buckwalter et al. describe the use of 1,3-diaryl guanidine-formaldehyde reaction products as one of the adhesive-forming components.

Jadamus et al. disclose a method of adhering a body of a thermoplastic polyphenylene ether containing molding compound to a body of a synthetic rubber material, consisting essentially of:

co-vulcanizing a body of said polyphenylene ether containing thermoplastic molding compound in contact with a body of said synthetic rubber containing a vulcanizing system of at least a vulcanizing agent and a vulcanizing accelerator and optionally other ingredients.

Jadamus et al. describe that whether one starts with the rubber in spherule form or in powder batch form, the covulcanizable rubber mixtures will invariably contain fillers such as

carbon black or silicic acid, extenders such as mineral oils, vulcanizing agents such as sulfur, vulcanization accelerators, and age protectors. A particularly suitable agent which promotes processibility is polyoctenylene (see Col. 7, lines 8-15). Further, the objects which can be manufactured from the covulcanizable masses include brake and coupled pressure plates, rubber-coated rolls, vehicle tires (see Col. 9, lines 1-16). According to Jadamus et al., excellent adhesive strength can be obtained, if a chemical bond is produced between PPE-containing material and certain double-bond-containing sulfur-vulcanizable rubbers (see Col. 4, lines 14-19).

Gifford et al. disclose a pneumatic tire having a bead and a sidewall portion, the bead and sidewall portion reinforced by an annular band, the annular band comprising:

a plurality of filaments having a high extensional modulus of elasticity and a high tenacity, bonded together in a matrix of resin;

the filaments are arranged to provide the annular band with a tapering configuration from the bead to the sidewall portion; and

wherein the resin is taken from the group consisting of epoxies, polyesters, nylons, and polyphenylene ethers and the filaments are taken from the group of aramid, fiberglass, carbon and polyesters. Gifford et al. describe that annular band 22 may be cured or formed from a thermoplastic resin such as, for example, nylons or polyphenylene ethers, or thermosetting resin such as, for example, epoxies or polyesters, but is preferably cured or formed from thermoplastic resins. Thus, Gifford et al. provide a light weight annular band for reinforcing a bead portion and a lower sidewall portion of a pneumatic tire which achieves a more uniform and homogeneous tire construction to increase a tire's useful life (see Col. 2, lines 13-21).

Ogawa discloses a mark for use in a rubber article comprising a chromatic rubber composition layer containing, for example, chloroprene rubber, an antioxidant-migration film barrier selected from a polyester film, a nylon film, a vinylidene chloride film and the like, and

an adhesive layer selected from the thermoplastic polyesters and thermoplastic polyurethanes. According to Ogawa, the migration of antioxidant from the rubber article is substantially completely prevented by using polyester film, nylon film, vinylidene chloride film or vinylidene chloride-vinyl chloride copolymer film which prevents the migration of staining antioxidant, particularly amine-series antioxidant (see Col. 11, lines 56-62).

Kaido et al. disclose a pneumatic tire having an air permeation preventive layer comprised of a cylindrical film or sheet heat-fused into a cylindrical shape and free from any connecting portion, said cylindrical film or sheet being composed of a polymer composition containing a thermoplastic resin or a blend of a thermoplastic resin and an elastomer component. The cylindrical thermoplastic resin film of Kaido et al. may be a single layer or may be a multiple layer film obtained by providing a polyolefin, aliphatic polyamide, or urethane type resin adhesive layer on the two surfaces of the film of the above resin (see Col. 9, lines 10-14). Kaido et al. describe that it becomes possible to lighten the weight of the tire without detracting from the retention of air pressure in the tire and, that by using as the air permeation preventive layer a cylindrical thermoplastic film, it becomes possible to improve the quality and reliability of the pneumatic tire and improve the efficiency of production of the pneumatic tire (see Col. 21, lines 24-37).

Lin et al. disclose a pneumatic tire comprising a plurality of reinforced rubber layers and an innerliner layer laminated together, the improvement which comprises said innerliner layer being a compositive structure comprising a least one layer of a thin film of a non-elastomeric barrier material. The surface layer of the innerliner can be any rubber which gives strong adhesion to both the carcass ply of the tire, which is usually the layer next to the innerliner in tire construction, and the barrier material. Thus, Lin et al. is directed to an improved pneumatic tire innerliner material which will provide substantially improved air pressure retention qualities while reducing the weight of the tire significantly compared to presently used tire innerliner materials (see Col. 1, line 67 to Col. 2, line 3).

Comparison of the Present Invention with the Prior Art References

It is the Applicant's position that none of the references relied upon by the Examiner disclose a process for producing a rubber-reinforced structure which includes the step of treating a surface of a polyamide resin layer with a specific solvent and the step of vulcanizing to bond directly a specific sulfur-containing rubber layer to the resin layer with a specific vulcanization-activating agent, without the use of an adhesive.

Freytag et al. and Buckwalter et al. disclose a process for producing a fiber reinforced tire which comprises vulcanizing to bond a sulfur-containing rubber to a polyamide fiber or textile. However, both references never disclose bonding a resin layer and a rubber layer to each other. It should be noted that a polyamide fiber is extremely different in the mechanism of the adhesion to a rubber from the polyamide layer. That is, in the case of the fiber, the rubber is impregnated in the fiber structure of the textile, or the whole face of the fiber is covered by the rubber. Accordingly, the fiber is bonded to the rubber by the structure (incorporating the fiber in the rubber) rather than by an interface adhesion of both. Further, the references fail to disclose both the solvent for treating the polyamide resin and the specific vulcanization-activating agent. It should be noted that in the case where the textile or fiber aggregate is treated by the solvent capable of dissolving or swelling the fiber, the fiber structure is destroyed.

Jadamus et al. disclose chemical bonding between the body of a thermoplastic polyphenylene ether and the body of a synthetic rubber material containing a polyoctenylene as an additive for vulcanization. Accordingly, Jadamus et al. fail to disclose the polyamide resin element. Also, since a polyphenylene ether is substantially different in chemical structure from a polyamide, the adhesion property of a polyamide and a rubber would not be predicted from that of a polyphenylene ether and rubber. In addition, Jadamus et al. never describe nor suggest the solvent for treating the resin body.

Gifford et al. disclose a tire having an annular band comprising filaments and a matrix such as nylon. However, Gifford et al. fail to disclose the Applicant's process for producing a tire. Further, since the annular band is contained or built in the tire, the adhesion of the rubber constituting the tire and the annular bend is not required. Accordingly, directly bonding the rubber layer to the resin layer without the use of an adhesive would not be motivated by Gifford et al. Further, Gifford et al. fail to disclose both the solvent for treating the polyamide resin and the specific vulcanization-activating agent.

By way of summary, since the resin members of the Freytag et al. and Buckwalter references are concerned with the adhesion of fibers and not the affect of the adhesion of a resin layer with a rubber layer, the present invention could never be predicted from the teachings of either of these references. The Jadamus et al. reference only discloses chemical bonding between the resin layer and the rubber layer and furthermore, the resin layer comprises a polyphenylene ether and as such, the results achieved by utilizing a polyamide layer, as defined by the present invention, could not be predicted from the teachings of the Jadamus et al. reference. In connection with the Gifford et al. reference, since the annular band is contained in the rubber tire, the effect of a direct bonding process without the use of an adhesive cannot be expected. Furthermore, since the Ogawa, Kaido et al. and Lin et al. references use an adhesive layer, one of the features of the present invention wherein direct bonding between the polyamide layer and the rubber layer is achieved without the use of an adhesive is not recognized. Accordingly, since all of the references relied upon by the Examiner fail to teach the process of the present invention wherein the surface of a polyamide resin is treated with a specific solvent, a specific sulfur-containing rubber layer is vulcanized so as to be bonded to a resin layer with the use of a specific vulcanization-activating agent and the polyamide resin layer and the rubber layer are directly bonded to each other at a significant high strength without the use of an adhesive, it is readily apparent that the present invention defines an inventive contribution which is not recognized by any of the references relied upon by the Examiner, either alone or in combination.

Accordingly, in view of the above amendments and remarks reconsideration of the rejections and allowance of all of the claims of the present application are respectfully requested.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Joseph A. Kolasch Reg. No. 22,463 at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37.C.F.R. §§1.16 or 1.14; particularly, extension of time fees.

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Respectfully submitted,

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